AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method for controlling materials quality in a rolling, forging, or leveling process, the method comprising:

conducting, at least once, each of ~~the heating step of~~ heating a metallic material, ~~the processing step of~~ rolling, forging, or leveling the metallic material, and ~~the cooling step of~~ cooling the metallic material; and

prior to manufacture of a metallic product of a desired size and shape, measuring qualitative data of the metallic material at a measuring position ~~by means of~~, using a materials quality sensor installed in a manufacturing line, and ~~then~~, in accordance with the qualitative data measured ~~data~~, making modifications to at least one of heating, processing, or cooling conditions ~~in at least one of the steps~~ upstream ~~with respect to~~ of the materials quality sensor so that the ~~quality~~ qualitative data of the metallic material at the measuring position agrees with target data.

2. (Currently Amended) A method for controlling materials quality in a rolling, forging, or leveling process, the method comprising:

conducting, at least once, each of ~~the heating step of~~ heating a metallic material, ~~the processing step of~~ rolling, forging, or leveling the metallic material, and ~~the cooling step of~~ cooling the metallic material; and

prior to manufacture of a metallic product of a desired size and shape, measuring qualitative data of the metallic material at a measuring position ~~by means of~~, using a materials quality sensor installed in a manufacturing line, comparing the qualitative data measured ~~data~~ with metallic material quality data estimates at the measuring position that have been calculated from actual heating conditions, processing conditions, and cooling conditions of the metallic material ~~by use of~~, using a materials quality model, modifying the materials quality model in accordance with results of the comparison ~~results~~, and determining subsequent heating conditions, processing conditions, and cooling conditions of the metallic material ~~in the respective steps, by use of~~ using the ~~modified~~ materials quality model as modified.

3. (Currently Amended) A method for controlling materials quality in a rolling, forging, or leveling process, the method comprising:

conducting, at least once, each of ~~the heating step of~~ heating a metallic material, ~~the processing step of~~ rolling, forging, or leveling the metallic material, and ~~the cooling step of~~ cooling the metallic material; and

prior to manufacture of a metallic product of a desired size and shape, measuring qualitative data of the metallic material ~~by means of~~, using a materials quality sensor installed in a manufacturing line, and ~~then~~, in accordance with the qualitative data measured ~~data~~, ~~conducting calculations on~~calculating at least one of heating, processing, or cooling conditions of the metallic material ~~in at least one of the steps~~, downstream with respect to the materials quality sensor ~~by means of~~, using a materials quality model so that ~~the~~ quality of the metallic material at a materials quality control point ~~provided in~~located at any position downstream with respect to the materials quality sensor will agree with target data.

4. (Currently Amended) A method for controlling materials quality in a rolling, forging, or leveling process, the method comprising:

conducting, at least once, each of the ~~heating step of~~heating a metallic material, ~~the processing step of~~rolling, forging, or leveling the metallic material, and ~~the cooling step of~~ cooling the metallic material; and

prior to manufacture of a metallic product of a desired size and shape, measuring qualitative data of the metallic material ~~by means of~~,using a materials quality sensor installed in a manufacturing line, and ~~then~~, in accordance with the qualitative data measured ~~data~~, ~~making modifications to~~modifying at least one of heating, processing, or cooling conditions of the metallic material ~~in at least one of the steps~~, downstream with respect to the materials quality sensor ~~by means of~~, using a materials quality model so that the quality of the metallic material at a materials quality control point ~~provided in~~located at any position downstream with respect to the materials quality sensor will agree with target data.

5. (Currently Amended) The rolling process materials quality control method according to ~~any one of claims~~claim 1 ~~to 4~~, wherein the manufacturing line comprises

a water-cooling site ~~at immediate rear~~immediately after of a processing site which uses a rolling mill, and

~~wherein the manufacturing line further comprises~~ a materials quality sensor at both or either of two locations, one location being between the processing site and the cooling site, and the other location being an outlet of the cooling site.

6. (Currently Amended) The materials quality control method according to ~~any one of claims~~claim 1 ~~to 5~~, wherein the materials quality sensor comprises ultrasonic wave transmitting means, ultrasonic wave ~~receiving~~detecting means, and signal processing means, ~~the materials quality sensor~~and the method includes detecting the quality of the metallic material based on ~~the basis of~~ultrasonic wave propagation characteristics of ~~an ultrasonic~~

~~wave within~~ the material.

7. (Currently Amended) The materials quality control method according to claim 6, wherein the material quality data detected by the materials quality sensor is ~~a~~ crystal grain size of a crystal-containing metallic material ~~present on an~~ in a path of ultrasonic wave propagation ~~route~~.

8. (Currently Amended) The materials quality control method according to claim 7, ~~wherein the ultrasonic wave transmitting means generates~~ including generating an ultrasonic wave by irradiating ~~the surface of~~ the metallic material with pulsed laser light.

9. (Currently Amended) The materials quality control method according to claim 7, ~~wherein the ultrasonic wave receiving means detects~~ including detecting ultrasonic vibration of ~~the surface of~~ the metallic material based on ~~the basis of~~ a phase difference between the laser light ~~irradiated onto~~ irradiatling the metallic material ~~surface~~, and a reflected beam of the ~~irradiated~~ irradiatling light.

10. (Currently Amended) The materials quality control method according to ~~any one of claims~~ claim 1 ~~to 9~~, ~~wherein the heating step is~~ including heating the material by induction ~~heating~~.

11. (Currently Amended) The materials quality control method according to ~~any one of claims~~ claim 1 ~~to 10~~, wherein the metallic material is ~~either~~ selected from the group consisting of an iron-containing alloy, an aluminum-containing alloy, a copper-containing alloy, ~~or~~ and a titanium-containing alloy.

12. (Currently Amended) The materials quality control method according to ~~any one of claims~~ claim 1 ~~to 9~~, ~~wherein the~~ including heating ~~step is allowing~~ an iron-and-steel material by induction ~~heater to heat an iron-and-steel material~~.

13. (Currently Amended) An apparatus for controlling materials quality in a rolling, forging, or leveling process, the apparatus comprising:

at least one means for each of heating a metallic material, rolling, forging, or leveling the metallic material, and cooling the metallic material;

data settings calculation means connected to a manufacturing line for manufacturing a metallic product of ~~a~~ desired size and shape, wherein, in accordance with information on ~~a~~

size and shape of the metallic material, on ~~a~~ target size and shape of the product, and on composition ~~and other factors~~ of the metallic material, the information being given from a host computer, the data settings calculation means calculates and outputs data settings ~~on~~for the heating means, the processing means, and the cooling means;

a heating controller, a processing controller, and a cooling controller which control a heater, a processor, and a cooler, respectively, based on the ~~basis of the~~ data settings;

a materials quality sensor installed in the manufacturing line ~~in order~~ to measure qualitative data of the metallic material; and

heating correction means, processing correction means, and cooling correction means, each of which, to ensure that the qualitative data measured by the materials quality sensor will agree with target data, corrects the data settings output from the data settings calculation means to the heating means, the processing means, and the cooling means ~~disposed~~, upstream with respect to the materials quality sensor.

14. (Currently Amended) An apparatus for controlling materials quality in a rolling, forging, or leveling process, the apparatus comprising:

at least one means for each of heating a metallic material, rolling, forging, or leveling the metallic material, and cooling the metallic material;

data settings calculation means connected to a manufacturing line for manufacturing a metallic product of ~~a~~ desired size and shape, wherein, in accordance with information on ~~a~~ size and shape of the metallic material, on ~~a~~ target size and shape of the product, and on composition ~~and other factors~~ of the metallic material, the information being given from a host computer, the data settings calculation means calculates and outputs data settings ~~on~~for the heating means, the processing means, and the cooling means;

a heating controller, a processing controller, and a cooling controller which control a heater, a processor, and a cooler, respectively, based on ~~the basis of~~ the data settings;

a materials quality sensor installed in the manufacturing line ~~in order~~ to measure, at a position, qualitative data of the metallic material;

materials quality model computing means for estimating, ~~by means of~~using a materials quality model, the quality of the metallic material at the measuring position from actual heating conditions, processing conditions, and cooling conditions of the metallic material;

materials quality model learning means for ~~conducting comparisons between~~comparing data measurements by the materials quality sensor ~~and~~to arithmetic results ~~by~~of the materials quality model computing means, and learning an error of the materials quality model; and

materials quality model correction means for correcting the materials quality model by correcting the arithmetic results of the materials quality model computing means in accordance with the learning ~~results~~ obtained by the materials quality model learning means~~;~~, wherein the data settings calculation means calculates and outputs data settings ~~on~~for each of the heating means, the processing means, and the cooling means, in accordance with ~~the~~ as-corrected-material quality data estimates that the materials quality model correction means outputs.

15. (Currently Amended) An apparatus for controlling materials quality in a rolling, forging, or leveling process, the apparatus comprising:

at least one means for each of heating a metallic material, rolling, forging, or leveling the metallic material, and cooling the metallic material;

data settings calculation means connected to a manufacturing line for manufacturing a metallic product of ~~a~~ desired size and shape, wherein, in accordance with information on ~~a~~ size and shape of the metallic material, on ~~a~~ target size and shape of the product, and on composition ~~and other factors~~ of the metallic material, the information being given from a host computer, the data settings calculation means calculates and outputs data settings ~~on~~of the heating means, the processing means, and the cooling means;

a heating controller, a processing controller, and a cooling controller which ~~controls~~control a heater, a processor, and a cooler, respectively, based on ~~the basis of~~ the data settings;

a materials quality sensor installed in the manufacturing line ~~in order~~ to measure qualitative data of the metallic material; and

materials quality model computing means for estimating, ~~by means of~~using a materials quality model, the quality of the metallic material at a materials quality control point ~~provided in~~located at any position downstream with respect to the materials quality sensor~~;~~, wherein the data settings calculation means calculates and outputs data settings ~~on~~for each of the heating means, the processing means, and the cooling means so that arithmetic results by the materials quality model computing means will agree with the target data given from the host computer.

16. (Currently Amended) An apparatus for controlling materials quality in a rolling, forging, or leveling process, the apparatus comprising:

at least one means for each of heating a metallic material, rolling, forging, or leveling the metallic material, and cooling the metallic material;

data settings calculation means connected to a manufacturing line for manufacturing a

metallic product of ~~a~~ desired size and shape, wherein, in accordance with information on ~~a~~ size and shape of the metallic material, on a target size and shape of the product, and on composition ~~and other factors~~ of the metallic material, the information being given from a host computer, the data settings calculation means calculates and outputs data settings ~~on~~for the heating means, the processing means, and the cooling means; and

a heating controller, a processing controller, and a cooling controller which control a heater, a processor, and a cooler, respectively, based on ~~the basis of~~ the data settings;

a materials quality sensor installed in a manufacturing line ~~in order~~ to measure qualitative data of the metallic material; and

heating correction means, processing correction means, and cooling correction means, each of which, to ensure that the quality of the material at a materials quality control point ~~provided~~located in any position downstream with respect to the materials quality sensor, will agree with the target data given from the host computer, correct the data settings output from the data settings calculation means to the heating means, the processing means, and the cooling means disposed downstream with respect to the materials quality sensor.

17. (New) The rolling process materials quality control method according to claim 2, wherein the manufacturing line comprises

a water-cooling site at immediately after of a processing site which uses a rolling mill, and

a materials quality sensor at both or either of two locations, one location being between the processing site and the cooling site, and the other location being an outlet of the cooling site.

18. (New) The rolling process materials quality control method according to claim 3, wherein the manufacturing line comprises

a water-cooling site at immediately after of a processing site which uses a rolling mill, and

a materials quality sensor at both or either of two locations, one location being between the processing site and the cooling site, and the other location being an outlet of the cooling site.

19. (New) The rolling process materials quality control method according to claim 4, wherein the manufacturing line comprises

a water-cooling site at immediately after of a processing site which uses a rolling mill, and

a materials quality sensor at both or either of two locations, one location being between the processing site and the cooling site, and the other location being an outlet of the cooling site.

20. (New) The materials quality control method according to claim 2, wherein the materials quality sensor comprises ultrasonic wave transmitting means, ultrasonic wave detecting means, and signal processing means, and the method includes detecting the quality of the metallic material based on ultrasonic wave propagation characteristics of the material.

21. (New) The materials quality control method according to claim 3, wherein the materials quality sensor comprises ultrasonic wave transmitting means, ultrasonic wave detecting means, and signal processing means, and the method includes detecting the quality of the metallic material based on ultrasonic wave propagation characteristics of the material.

22. (New) The materials quality control method according to claim 4, wherein the materials quality sensor comprises ultrasonic wave transmitting means, ultrasonic wave detecting means, and signal processing means, and the method includes detecting the quality of the metallic material based on ultrasonic wave propagation characteristics of the material.

23. (New) The materials quality control method according to claim 2, including heating the material by induction.

24. (New) The materials quality control method according to claim 3, including heating the material by induction.

25. (New) The materials quality control method according to claim 4, including heating the material by induction.

26. (New) The materials quality control method according to claim 2, wherein the metallic material is selected from the group consisting of an iron-containing alloy, an aluminum-containing alloy, a copper-containing alloy, and a titanium-containing alloy.

27. (New) The materials quality control method according to claim 3, wherein the metallic material is selected from the group consisting of an iron-containing alloy, an aluminum-containing alloy, a copper-containing alloy, and a titanium-containing alloy.

28. (New) The materials quality control method according to claim 4, wherein the metallic material is selected from the group consisting of an iron-containing alloy, an aluminum-containing alloy, a copper-containing alloy, and a titanium-containing alloy.

29. (New) The materials quality control method according to claim 2, including heating an iron-and-steel material by induction.

30. (New) The materials quality control method according to claim 3, including heating an iron-and-steel material by induction.

31. (New) The materials quality control method according to claim 4, including heating an iron-and-steel material by induction.